

Marked-up versions of the amended claims are provided in an annex to this response.

**REMARKS**

Claims 1 through 12 are pending in the subject application. Claims 2 and 12 stand rejected under 35 U.S.C. 112, second paragraph. Claims 1-12 stand rejected under 35 U.S.C. 103(a). Claims 1, 2, and 12 have been amended.

The Applicants appreciate the Examiner's thorough examination of the subject application. However, the Applicants respectfully request reconsideration of the subject application based on the above amendments and the following remarks.

**35 U.S.C. § 112 REJECTION**

The Examiner rejected claims 2 and 12 under 35 USC 112, second paragraph as being indefinite for failing to point out and distinctly claim the subject matter that the Applicants regard as their invention. Claims 2 and 12 have been amended. Accordingly, the Applicants assert that the grounds for rejection are moot.

It is respectfully submitted that, for the foregoing reasons, claims 2 and 12 satisfy the requirements of 35 U.S.C. 100, et seq., especially § 112, second paragraph. As such, the Applicants believe that claims 2 and 12 are allowable. Moreover, it is respectfully submitted that the subject application is in condition for allowance. Early and favorable action is requested.

35 U.S.C. § 103(a) REJECTION

The Examiner rejected claims 1, 2, and 12 under 35 USC 103(a) as being unpatentable over U.S. Patent Number 6,323,929 to Hirakata ("Hirakata" or the "Hirakata Reference"); claims 3-7 and 10 under 35 USC 103(a) as being unpatentable over Hirakata in view of U.S. Patent Number 6,104,467 to Nakahara, et al. ("Nakahara" or the "Nakahara Reference"); claims 8-9 under 35 USC 103(a) as being unpatentable over Hirakata in view of Nakahara further in view of U.S. Patent Number 6,327,011 to Kim ("Kim" or the "Kim Reference"); and claim 11 under 35 USC 103(a) as being unpatentable over Nakahara. The Applicants respectfully traverse these rejections for the reasons provided in greater detail below.

Claims 1, 2 and 12

With respect to claims 1, 2, and 12, the Examiner asserts that the Hirakata reference discloses all of the elements of the invention as claimed except that it "does not disclose that a cell gap is formed so as to gradually increase from a center to an end of a display area at room temperature." According to the Examiner, those skilled in the art would have known to use "a contrary compensation for the thermal expansion . . . to compensate the thermal expansion effect at the higher atmospheric temperature." The Applicants respectfully disagree.

The present invention provides a liquid crystal display ("LCD") device that prevents irregular display color, which can result at relatively high operating temperatures, e.g., around 60 to 70 degrees Centigrade (°C), by forming a cell gap that, at room temperature, gradually increases from the center to an end of a display area, which is to say that, at room temperature, the cell gap at the center of the LCD cell is smaller than the cell gap at the ends of the LCD cell. See, e.g., Application, page 6, lines 16-18 and page 12, lines 2-7. As a result, this arrangement reduces the cell gap difference, i.e., between the center gap and the end gaps, which can cause irregular display color, at higher temperatures. Indeed, the present invention can

account for the difference in thermal expansion of the liquid crystal material and the sealing material. See, e.g., Id., page 6, line 22 to page 7, line 1.

According to the Examiner, the Hirakata reference (FIG. 3) illustrates an arrangement in which the cell gap at the center part is smaller than the cell gap at the peripheral part, i.e., end of a display area. However, in FIG. 3 of the Hirakata reference, the cell gap  $d$  in the display area has almost uniform thickness except in a portion of the peripheral part 204. Thus, the cell gap is not formed "so as to gradually increase from a center to an end of a display area" as claimed by the present invention. Instead, the cell gap  $d$  is substantially constant in the center part 203 and only increases at the peripheral part 204.

The Applicants respectfully maintain that, the arrangement of Hirakata cited by the Examiner is equivalent to the arrangement illustrated in Fig. 14 of the present application. Thus, the Applicants respectfully assert that, the arrangement of Hirakata cannot resolve the appearance of an irregular display color due to a change in atmospheric temperature, as taught in claims 1, 2, and 12 of the present application, in which the cell gap is formed so as to gradually increase from the center to the ends of a display area at room temperature.

Moreover, according to Hirakata,

interference fringes as shown by FIG. 2B appear at part 204 where the positional variation of the cell gap is large. No interference fringes appear at the center part 203 of the liquid crystal cell because the cell gap barely varies there.

Hirakata, col. 2, lines 15-19. By comparison, with the present invention, at room temperature, when the cell gap at the center is smaller than at the ends, there is no interference fringe. Indeed, the cell gap of the present invention gradually increases from the center to the ends of the display area "in a range that no irregular display color[,i.e., interference fringe,] appears." Application,

page 11, lines 16-19 (Emphasis added). Thus, the Applicants maintain that it would not have been obvious to those skilled in the art to arrange a cell gap that increases gradually from the center to the ends to compensate for temperature changes from about 25°C to about 60 or 70°C. The prior art cited by the Examiner does not address the effect of temperature change on the cell at all and, furthermore, begins with a cell that already has an interference fringe.

Accordingly, the Hirakata reference neither teaches, mentions nor suggests resolving irregular display color of the LCD device resulting from a change in an atmospheric temperature by means of controlling the cell gap, and, more particularly, by forming a cell gap between the pair of insulating substrates so as to increase gradually from the center to the end of the display area at room temperature. Accordingly, the Applicants respectfully assert that, claims 1, 2, and 12 are not made obvious by the combination of the two references.

Claims 3-7 and 10

The Nakahara reference cannot make up for the deficiencies of the Hirakata reference. Indeed, the Nakahara reference neither teaches, mentions nor suggests resolving irregular display color of the LCD device resulting from a change in an atmospheric temperature by means of controlling the cell gap, and, more particularly, by forming a cell gap between the pair of insulating substrates so as to increase gradually from the center to the end of the display area at room temperature. Accordingly, the Applicants respectfully assert that, claims 3-7 and 10 are not made obvious by the combination of the two references.

Claims 8-9

Similarly, the Kim reference cannot make up for the deficiencies of the Hirakata and Nakahara references. Indeed, the Kim reference neither teaches, mentions nor suggests resolving irregular display color of the LCD device resulting from a change in an atmospheric temperature by means of controlling the cell gap, and, more particularly, by forming a cell gap between the pair of insulating substrates so as to increase gradually from the center to the end of the display area at room temperature. Accordingly, the Applicants respectfully assert that, claims 8-9 are not made obvious by the combination of the three references.

Claim 11

Again, the Nakahara reference cannot make up for the deficiencies of the Hirakata reference. Accordingly, the Applicants respectfully assert that, claim 11 is not made obvious by the combination of the two references and the admitted prior art.

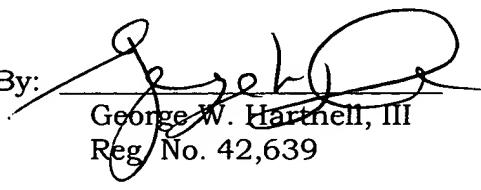
It is respectfully submitted that, for the foregoing reasons, claims 1-12 satisfy the requirements of 35 U.S.C. 100, et seq., especially § 103(a). As such, the Applicants believe that claims 1-12 are allowable. Moreover, it is respectfully submitted that the subject application is in condition for allowance. Early and favorable action is requested.

The Applicant believes that no additional fee is required for consideration of the within Response. However, if for any reason the fee paid is inadequate or credit is owed for any excess fee paid, you are hereby authorized and requested to charge Deposit Account No. **04-1105**.

Respectfully submitted,

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**ANNEX TO RESPONSE TO OFFICE ACTION**  
**INCLUDING MARKED-UP VERSION OF AMENDED CLAIMS**

1. (Amended) A liquid crystal display device, comprising:  
a pair of insulating substrates bonded via a sealing material, and  
liquid crystal filled between said a pair of said-insulating substrates,  
wherein a cell gap is formed so as to gradually increase from a center  
to an end of a display area at room temperature.
2. (Amended) A liquid crystal display device, comprising:  
a pair of insulating substrates bonded via a sealing material, and  
liquid crystal filled between said a pair of said-insulating substrates,  
wherein a cell gap is formed so as to gradually increase from a center  
to an end of a display area at room temperature in a range of the cell gap  
that no irregular display color appears, ~~so that it is possible to smooth out~~  
~~a difference in thermal expansion amounts between said liquid crystal and~~  
~~said sealing material at a high temperature.~~
12. (Amended) A liquid crystal display device, comprising:  
a pair of insulating substrates bonded via a sealing material, and  
liquid crystal filled between said a pair of said-insulating substrates,  
wherein a cell gap is smaller in a center than any other part of a display area  
at room temperature such that a cell gap difference is set at a predetermined amount  
between the center and an end of said display area at a high temperature in a range  
of the cell gap that no display defect occurs.